

In re: Park et al.
Application No. 10/715,314
Filed: November 17, 2003
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REMARKS

This response is submitted in reply to the Office Action mailed November 1, 2005 ("the Action"). Original Claims 1-38 were subject to a 5-way restriction. Claims 1-7 are pending in the Action (with new Claims 39-48 added), with method Claims 8-11 canceled as being directed to non-elected claims. Claims 12-38 were canceled previously in response to the restriction. Claims 1-7 stand rejected as being anticipated by and/or obvious over U.S. Patent No. 6,899,607 ("Brown").

I. Claims 1-3 and 5-7

The Action states that Brown anticipates Claims 1-3 and 5-7, as Brown proposes a polishing system for use with semiconductor substrates that uses a pressurization structure with a (lower) magnet 12 (col.6, lines 28-30), each with a corresponding stationary second (upper) electromagnet 14 (col. 6, lines 45-50 and Figures 1 and 1A). The actuators 14 are substantially stationary (col. 6, line 46) and configured so that magnetic fields emanating therefrom will repel the corresponding structure 12 (col. 6, lines 57-59). Brown does state that "alternatively" structures 12 may be attracted toward their respective actuators (col. 7, lines 27-29). Notably, however, Brown fails to teach or suggest configuring the device to change polarity during operation to selectively repel or attract a permanent magnet using the actuator 14.

Brown states that actuators 14 (electromagnets) "are oriented such that the north poles N thereof face, or are closest to, the north poles of the corresponding pressurization structures 12" or so that "south poles of pressurization structures 12 and the magnetic fields of the electromagnets of their corresponding actuators may alternatively face one another" (col. 6, lines 48-52). The apparatus also includes springs 13 that pull structure 12 away from backside 24 of semiconductor structure 20 in the absence of a magnetic field emanating from actuator 14 (col. 7, lines 23-27). Brown proposes using different strengths of magnetic fields applied by actuator 14 (electromagnets) to vertically moveable structures 12 which determines the amount of force with which the structure 12 is biased against the backside 24 of the semiconductor structure 20 (col. 6, lines 60-64).

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Claim 1 recites:

A polishing apparatus comprising:
a rotatable turntable having a polishing pad;
a carrier head configured to cooperate with the polishing pad to hold a target workpiece to be polished in alignment with the polishing pad on the turntable; and
a magnetic field control unit comprising a plurality of spaced apart first magnetic field sources disposed inside the carrier head, for generating respective first magnetic forces, and a plurality of second magnetic field sources disposed inside the carrier head configured to generate respective second magnetic forces with each second magnetic field source comprising an electromagnet, a respective one of the plurality of second magnetic field sources being substantially spatially aligned with a respective one of the first magnetic field sources to define a magnetic field source pair, each magnetic field source pair being spaced apart from the others, wherein, in operation, the second magnetic field source in each magnetic field source pair is configured to selectively repel or attract the first magnetic field source such that, in operation, polarity of an electromagnet can reverse, and wherein, during operation, electromagnets in adjacent magnetic field source pairs have opposing polarity.

Notably, Brown fails to teach or suggest the subject matter of Claim 1, including, *inter alia*, the capability of reversing the polarity of an electromagnet during operation (see, e.g., ¶¶ 23, 39, 41, 54) or allowing adjacent upper electromagnets to have a different polarity during different or all periods of operation (see, e.g., Figures 4, 5A, 5B of the pending application).

In view of the above, Applicant respectfully submits that Claims 1-3 and 5-7 are patentable over Brown.

II. Claim 4

The Action also rejects Claim 4, which recites that the electromagnet resides under the permanent magnet because the Action alleges that a "reversal of locations" is obvious because it has been held that rearranging parts involves only routine skill. Applicant respectfully disagrees.

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Applicant submits that it is much more difficult to arrange the electromagnets (and power lines) in a lower portion of the carrier head and, absent the teachings of the instant invention, one would not have been motivated to reconfigure a carrier head as claimed. Further, the structure 12 of Brown moves up toward actuator 14; rearranging this so that structure 12 resides above the actuator 14 would result in an inoperable configuration. Applicant submits that the claimed configuration recited in Claim 4 is non-obvious over Brown.

III. New Claims

Applicant has added new Claims 39-48 to form a more complete claim set. The claims are supported by the application.

Applicant submits that the device of Brown proposes the use of eight discrete magnet compartments with eight discrete structures 12 in a rotating head (col., 8, line 12 and Figures 1, 2), each being "relatively tall structures" (col. 6, lines 22-25), with the structure 12 vertically movable toward the actuator 14.

In contrast, embodiments of the instant invention provide a less complex arrangement with three permanent magnet spaces, which may include a cylindrical center magnet 111a and annular intermediate and outer annulus magnets (Figure 4, 5A, 5B). In further contrast, in some embodiments, the permanent magnets of the instant invention are substantially static in the carrier head with the pressure controlled by the magnetic field strength applied in each magnet pair region of the carrier head.

Independent Claim 41 recites, *inter alia*,

a magnetic field control unit comprising three spaced apart magnet regions disposed inside the carrier head, each region holding a magnet field source pair, each magnet field source pair comprising at least one permanent magnet for generating a first magnetic force, and an aligned corresponding electromagnet configured to generate a second magnetic force, wherein, in operation, the electromagnet in at least one magnetic field source pair is configured to alter polarity to selectively repel or attract the corresponding at least one permanent magnet.

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Independent Claim 46 recites, *inter alia*:

wherein, in operation, the second magnetic field source in each magnetic field source pair is configured to selectively repel or attract the first magnetic field source such that, in operation, polarity of an electromagnet can reverse.

Dependent Claims 39, 42 and 47 are directed to three-magnet region configurations.

Dependent Claims 40, 43, and 48 are directed to static permanent magnet arrangements.

Dependent Claim 45 is directed to certain electromagnets having opposing polarity.

Applicant respectfully submits that the new claims are patentable over the cited reference.

CONCLUSION

Accordingly, Applicants submit that the present application is in condition for allowance. Should the Examiner have any matters outstanding of resolution, she is encouraged to telephone the undersigned at 919-854-1400 for expeditious handling.

Respectfully submitted,

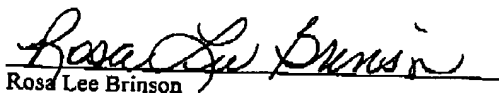


Julie H. Richardson
Registration No. 40,142

USPTO Customer No. 20792
Myers Bigel Sibley & Sajovec
Post Office Box 37428
Raleigh, North Carolina 27627
Telephone: 919/854-1400
Facsimile: 919/854-1401

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Rosa Lee Brinson